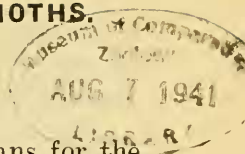


SECONDARY SEXUAL CHARACTERS IN BRITISH MOTHS.

By DESMOND MURRAY.

Plate II.

13,820



That many moths as well as butterflies possess special organs for the diffusion of scent, specialised scales, hair-brushes, plumes on the wings and in some cases on the legs or other parts of the body, has been known for a number of years. As far back as the year 1876, Fritz Müller made some valuable observations with tropical species.

His papers, translated into English, are given as an appendix (with some fine plates) by Longstaffe in *Butterfly Hunting in Many Lands*, 1912.

Though, no doubt, there have been other contributions to this interesting subject, these are scattered in various journals and are not easy to find. Two small books by Eltringham, *Butterfly Lore* and *The Senses of Insects*, are a good introduction to the subject. Tutt gave us a paper on the subject in 1892, which helps us further.

It is true to say, however, that the subject has not received the close attention it deserves. With our own native species, very few observations have been made, as far as one can ascertain.

The Notodonts have many peculiar features not found in other groups. With most of them the hind claspers of the larva are wanting, the body being held up in a peculiar fashion. Sometimes the end of the body is adorned with long whip-like processes, as in *vinula*, *furcula* and *bifida*. In others the larva takes on a most extraordinary form, as in *fagi*. There is a species in S. Africa, *Rigema ornata*, Wlkr., in which the larva is covered with clubbed spines down each side of the body. If you had seen it trying to change its skin, a seemingly impossible task, you would say it was well worthy of a cinema picture. The amazing contortions which it is obliged to go through to accomplish its object are truly extraordinary.

In the larval state some are also found to have an organ between the prolegs, which ejects a liquid—"formic acid"—as a deterrent to enemies. This organ has been noticed in the case of *vinula*, *plumigera*, *nubeculosa* and *crenata* (vide Buckler's *Larvae*, Vol. ii, p. 156).

Even in the pupa state this group is peculiar, though this particular habit is not confined to them. The empty cocoons of *bifida* and allied species may sometimes (perhaps) be found, as they can be seen more easily by their lighter colour, the change being caused by some form of caustic potash, ejected to soften the hard cocoon, before the moth emerges.

In all its early stages therefore, this family appears singular. In the perfect state the peculiar shape of the forewing is found to be, on closer examination, not just a curve in the wing, but some form of sense-organ, either for the diffusion or for the reception of scent.

This organ is noticeably present in *palpina*, *trepida* and *dromedarius*, and of the same formation in *camelina* and *ziezac*. In *cuculla*, *carmelita* and *bicoloria* it is present, but smaller. Even in *plumigera*, the organ of specialised scales is present, though the male insect is adorned with such wonderfully plumed antennae.

When the patch on the forewing is magnified, it is seen to consist of a mass of clubbed setae, which stand up prominently when the wings

are closed over the body. The name "Prominent" was no doubt given on account of the humps possessed by many of the larvae, but it is equally appropriate with regard to the perfect insect.

What function then does this organ fulfil? It has yet to be realised how perfectly adapted and how well equipped many of these tiny insects are in the various stages of their peculiar economy and how very little we know about them.

The organ is either for the diffusion of scent to attract the partner or it is a receptive organ of scent, which helps in finding the whereabouts of the other sex.

In many instances, notably in certain tropical butterflies, a similar organ is found on the wing of the male insect. In most of the species mentioned in the present instance the female also seems to possess the organ, though it is less prominent and generally smaller. If the scales give forth a scent in both sexes this mutual inter-communication would most probably be received by the antennae.

If, on the other hand, it be a receptive organ it could function for the same purpose, i.e., as a means of communication. When the wings are closed, the specialised scales stand up straight over the body, like a cluster of so many tiny pylons, to give forth or to receive the waves of scent through the ether. The organ is directly connected with the nervures of the wing and therefore with the thorax and the antennae, so that stimulus and direction would thus be given.

Certainly the organ must have some such function, acting as a secondary sexual character.

Many butterflies are furnished with scent-brushes, of which Muller says:—"These are usually sheltered from exposure to the air, enclosed between the fore and hindwings or in some other manner, or at least while at rest enclosed between the closed upright wings. The scent is not diffused at the wrong time and so wasted but collects between the densely packed scales among the hairs, brushes and manes. One could hardly find a more effective method of employing any oderiferous substance than that of saturating with it the hairs of a brush and then suddenly opening them out, in all directions, so as to provide an enormous surface for evaporation."

This is not exactly the same case with these moths, as the organ on account of its position is always exposed to the air, but the function must in some way be similar.

A problem that also arises, even though we know the real function of these sense-organs, is why some species possess them, in one form or another, and yet they are entirely absent in other species. Why should some need them and not others? One cannot venture to answer the question, but it is a subject that would repay closer attention and investigation.

Other genera of moths have scent-bags on the hindwings or plume-brushes on the legs of the male; in some cases the tibiae have been found to emit a peculiar perfume.

"These hairs (on the legs) are capable of being erected, forming a kind of very dense brush, and it is in the state of erection that their scent can be perceived" (Müller).

This points to the same need being fulfilled in another way. Look, for instance, at the male *derasa*, the "Buff Arches," and you will be

surprised that the wonderful plume-brush on the second or middle pair of legs does not seem to have been noticed before. It is not only a fine plume of fawn-coloured hairs but it has a silk-like case or purse attached to the tibia, into which it can be neatly packed away. For this reason perhaps it has escaped notice, and it is also hidden away under the forewing close to the body. The male of *Leucania litoralis* has a similar scent-brush on the under hind-part of the body. Other common native species as *P. gamma* and *P. meticulosa* have prominent hair-tufts, either on the body or on the thorax.

Amongst the Geometrae the male of the two small moths, *Lobophora sczalata* and *L. halterata* (the Seraphim), have a large, oblong, fringed, snowy-white lobe or pocket at the base of the hindwing (covered in repose), giving the appearance of an extra wing.

Scotosia retulata and *S. rhamnata* (Brown Scaliop and Dark Umber) have an extraordinary large trifid tuft, terminating the body of the male, to which Haworth drew special attention. The two species of the *Hepialidae*, *humuli* and *hectus* have the hind leg of the male aborted, forming a scent gland. In some of these cases we do not know the function of these special organs and when they are for the diffusion of scent why are they present in these particular cases?

When closely allied species from abroad are examined it is found that similar yet more elaborate organs are present.

There is then a wide field here for investigation. "As yet an unexplored and promising harvest of new and interesting facts," Müller said over sixty years ago.

EXPLANATION OF FIGURES ON PLATE.

1. Wing of *Pterostoma palpina* showing sense-organ and section enlarged.
2. *Lophopteryx camelina* at rest, showing position of sense-organ, natural size.
3. Middle leg of male *Habrosyne derasa* with scent brush and silk-like container $\times 5$, back and front.

THE GENETICS OF RHYACIA RUBI, VIEW., AB. OCHRACEA, WALKER, AND AB. FLAVA, WALKER.

By E. A. COCKAYNE, D.M., F.R.C.P., F.R.E.S.

Walker's notes on the breeding of these rare forms published in the *Entomologist's Record*, 1902, 14, 171, and 1903, 15, 55, are scanty, but sufficient to make it almost certain that the yellow forms are recessive to the red. The results may be condensed as follows:—

- (1) Unknown male (? DR) \times *ochracea* female (RR)—Progeny *ochracea* 25 per cent., *flava* 14 per cent. All yellow forms 39 per cent. Red forms, *quadratum*, Hb. and typical, in approximately equal numbers, 61 per cent.
- (2) From this brood a male *flava* \times a female *ochracea* gave 9 yellow offspring in the same year, 3 *flava* and 6 *ochracea*. The rest of the brood, which passed the winter as larvae, produced yellow forms